3. Release B Overview

3.1 Release B Objectives

3.1.1 ECS Mission Support Baseline

The Release B mission fully supports all requirements of Release A as well as extending beyond these capabilities to support the Landsat-7, AM-1, RADARSAT, ERS1-2, and JERS missions in the near term and ADEOS II and other missions, as shown in Table 3-1 below, in later years. Release B also supports the Data Assimilation Office (DAO) at the GSFC DAAC.

Table 3-1. Mission Baseline

Mission	Instruments	Launch Date
TRMM	CERES, LIS, VIRS, PR, TMI	17 August, 1997 Initially Supported by ECS Release A
EOS AM-1	ASTER, CERES, MISR, MODIS, MOPPIT	30 June, 1998
Landsat 7	ETM+	May, 1998
FOO	COLOR	July, 1998
ADEOS II	SeaWinds	February, 1999
RADAR ALT(CNES or GFO)	MR, DFA	March, 1999
FOO	ACRIM	June, 1999
Space Station	SAGE III	June, 2000
EOS PM-1	AIRS, AMSU, CERES, MIMR, MODIS, MHS (NOAA)	December, 2000
CHEM	HIRDLS, MLS, CII, TES	December, 2002
LASER ALT	GLAS	July, 2003

Release B will be designed to assure successful transition to support future releases. Releases C and D will support future EOS missions, such as EOS PM-1, and will incorporate evolutionary changes such as new processing and storage technologies, new distributed computing infrastructure, and expanded data metaphors and services. Successive releases will provide expanded and increasingly enhanced data search and access, based on feedback from the science community.

3.1.2 Release B Capabilities

The Earth Observing System (EOS) Data and Information System (EOSDIS) Core System (ECS) capabilities are developed in terms of four formal releases. Release B, the second formal ECS release, builds on Release A and provides capabilities that are designed to support the AM-1, Landsat-7, RADAR ALT, ERS-1, ERS-2, and JERS-1 missions, as well as provide support for the SeaWinds and COLOR instruments.

Release A capabilities include support to the scheduled launch and ongoing operations for Tropical Rainfall Measurement Mission (TRMM), interface testing for Landsat-7, and command and control interface testing for AM-1. Release A supports data operations at three Distributed Active Archive Centers (DAACs). The DAACs activated in Release A are located at Goddard Space Flight Center (GSFC), Langley Research Center (LaRC), and the EROS Data Center (EDC). In addition, Release A provides support for the System Monitoring & Coordination Center (SMC).

Release B expands the capabilities of Release A by providing full functionality and services required for AM-1 launch and data operations, for supporting Landsat-7 operations, and for providing on-going operational support for TRMM. Release B also provides capabilities to support the COLOR, ADEOS II, RADAR ALT, ACRIM, and METEOR missions. Release B also provides the means by which ECS users may gain access to and receive Synthetic Aperture Radar (SAR) products from the ERS-1, ERS-2, JERS-1, and the RADARSAT missions, which are processed and archived at the Alaska SAR Facility.

Release B is deployed at eight sites - the original Release A sites (SMC, and DAACs at GSFC, LaRC and EDC), plus four additional DAAC sites - the National Snow and Ice Data Center (NSIDC), the Jet Propulsion Laboratory (JPL), the Oak Ridge National Laboratory (ORNL), and the Alaska SAR Facility (ASF).

Release A and B software is also provided to an eighth DAAC site, the Socio-Economic Data and Applications Center (SEDAC), at the Consortium for International Earth Science Information Network(CIESIN) in Saginaw, Michigan.

The Release B communications interfaces include the National Aeronautics and Space Administration (NASA) Science Internet (NSI), the NASA Communications (NASCOM) Operational Local Area Network (NOLAN), and the EOSDIS Backbone Network (EBnet). These interfaces are physically located at the SMC and at the ECS GSFC, LaRC, EDC, NSIDC, JPL, ORNL, and ASF DAAC sites. The communications networks connect ECS to data providers at the Sensor Data Processing Facility (SDPF), the ECS Data and Operation System (EDOS), the Landsat Processing System (LPS), the NOAA ADC, the TRMM Science Data and Information System (TSDIS), the EOSDIS Version 0 system, the processing facility at the ASF, and the sources of Level-0 data for COLOR, ADEOS II, RADAR ALT, ACRIMSAT and the METEOR missions. The data users for Release B are the science user community connected to the eight DAACs (including SEDAC), the SCFs, and the ASTER GDS.

Figure 3.1-1 depicts the inter-connection of individual ECS sites with external systems, and internal ECS connectivity for routine mission related operations. In Appendix A, Section A.1, are tables summarizing for each Release B mission the data flow sources and destinations, communication carrier, and data content among elements shown in Figure 3.1-1.

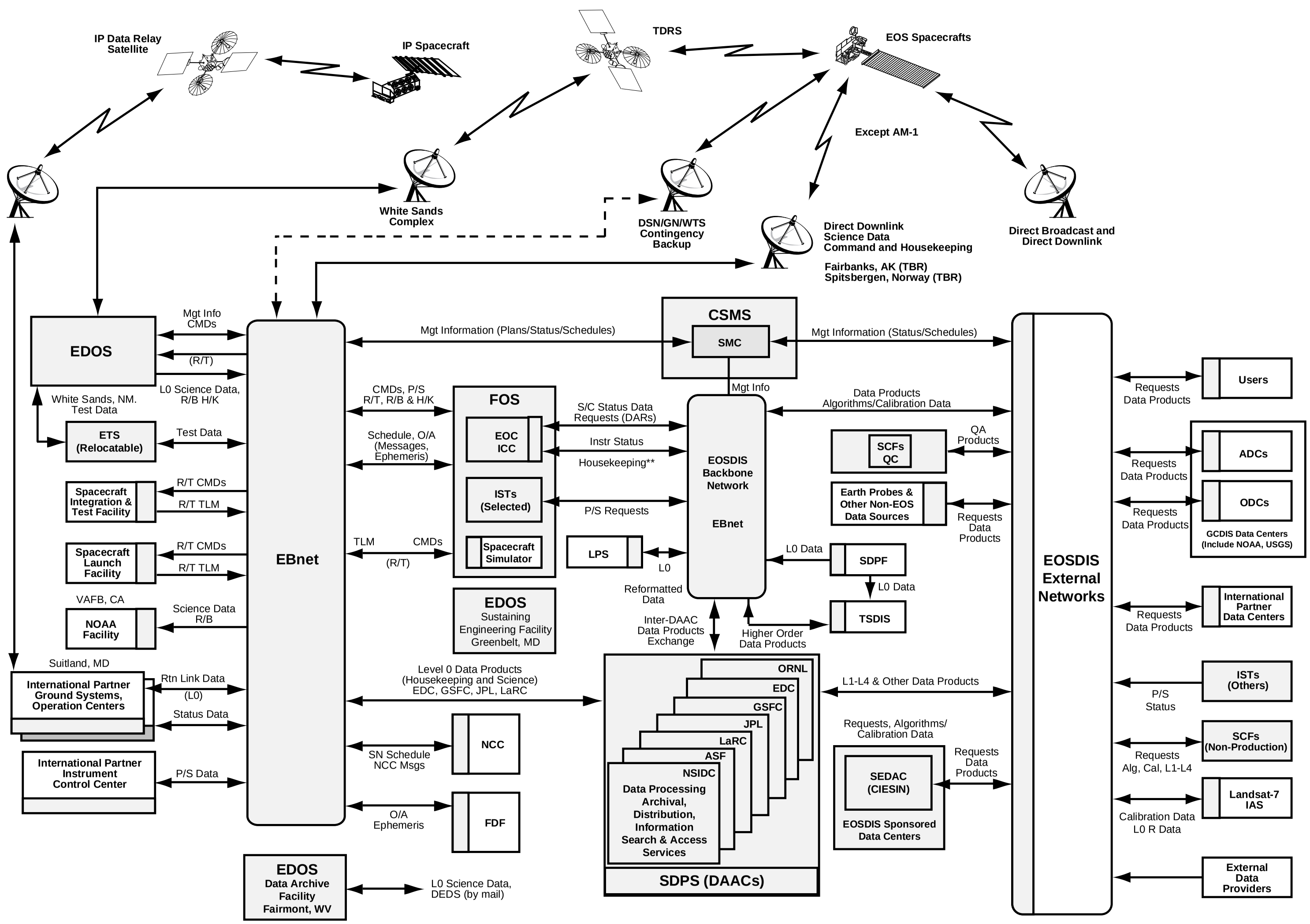

Figure 3.1-1. ECS Element Interfaces and Data Flows

3.1.3 Release B Instrument and DAAC Support

Release B supports the following instrument data operations and DAACs.

- AM-1 Support:

  Release B supports the processing and distribution of instrument data from a complement of five AM-1 instruments. These instruments are the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER); Clouds and Earth's Radiant Energy System (CERES); Multi-Imaging SpectroRadiometer (MISR); Moderate-Resolution Imaging SpectroRadiometer (MODIS); and Measurements Of Pollution In The Troposphere (MOPITT).

  Release B provides data and information management interfaces to support the processing of:

  – ASTER instrument data. This includes the receipt of ASTER level-1 data on magnetic tape at EDC from Japan, and the production and distribution of higher level ASTER products by EDC.

  – CERES instrument data. This includes the receipt of CERES level-0 data; and the production, archive, and distribution of levels 1, 2 & 3 by LaRC.

  – MISR instrument data. This includes the receipt of MISR level-0 data; and the production, archive, and distribution of levels 1, 2 & 3 by LaRC.

  – MODIS instrument data. This includes the receipt of MODIS level-0 data; production, archive and distribution of levels 1A, 1B & 2 data; and production and distribution of level 3 & 4 data by GSFC. It includes the ingest of levels 2-4; and the production, archive, and distribution of level 3 data by EDC. It also includes the ingest of level 2; and the production, archive, and distribution of level 3 data by NSIDC.

  – MOPITT instrument data. This includes the receipt of MOPITT level-0 data; and the production, archive, and distribution of levels 1, 2 & 3 by LaRC.

- Landsat-7 Support:

  Release B provides the Landsat-7 ground support system needed for data operations. The ECS interfaces with the Landsat-7 system elements include the Mission Management Office (MMO), International Ground Stations (IGS), and the Ground Data Processing System (GDPS). The GDPS is composed of the Landsat-7 Processing System (LPS) and the Image Assessment System (IAS).

  The ECS interfaces are those needed for: the receipt of product cost information and exchange of registration service and system management status from the MMO; the receipt of inventory and browse data from the IGS; the receipt and storage of Landsat-7 level-0R data (view-able image data with radiometric and geometric information appended but not applied), and metadata and browse data from the LPS; and the receipt of calibration data and metadata from the IAS. Interfaces for data search, order and distribution services to Landsat-7 users are also implemented in Release B.

- COLOR Support:

  Release B provides data and information management interfaces to support the processing of COLOR instrument data. This includes the ingest of COLOR level 0 data; and the production, archive and distribution of levels 1-3 by GSFC.

- ADEOS II - SeaWinds Support:

  Release B provides data and information management interfaces to support the processing of ADEOS II SeaWinds instrument data. This includes the ingest of SeaWinds level 0 data and non-redundant Advanced Microwave Scanning Radiometer (AMSR) level 2 data by JPL.

- RADAR ALT - DFA and MR Support:

  Release B provides data and information management interfaces to support the processing of RADAR ALT Dual Frequency Altimeter (DFA) and Microwave Radiometer (MR) instrument data. This includes the ingest of DFA and MR level 0 data; and production, archive and distribution of DFA level 1 - 4 and MR level 1B data by JPL.

- ACRIMSAT Support:

  Release B provides data and information management interfaces to support the processing of Active Cavity Radiometer Irradiance Monitor (ACRIM) instrument data. This includes the ingest of ACRIM level-0 data; and the production, archive, and distribution of level 1A data by LaRC.

- METEOR - SAGE III Support:

  Release B provides data and information management interfaces to support the processing of Stratospheric Aerosol and Gas Experiment III (SAGE III) instrument data. This includes the ingest of SAGE III level-0 data; and the production, archive, and distribution of levels 1 & 2 data by LaRC.

- Alaska SAR Facility Support:

  Release B provides access to and distribution of levels 0-3 ERS-1, JERS-1 ERS-2, and RADARSAT data. Release B provides the capability to archive and retrieve level 0 - 3 ERS-1, JERS-1, ERS-2, and RADARSAT data that has been selected for access and distribution from the Alaska SAR Archive.

- GSFC Data Assimilation Office Support:

  Release B provides data and information management interfaces to support the DAO in processing data from NOAA's National Meteorological Center (NMC), AM-1 instruments, the TRMM TMI instrument, the Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave/Imaging (SSM/I) instrument, and the Advanced Earth Observing Satellite (ADEOS) NASA Scatterometer (NSCAT) instrument. This includes the ingest of NMC levels 1-3 data sets; and the production, archive, and distribution of DAO level 4 data by GSFC.

Table 3-2 provides a summary of the DAAC and SMC support provided in Release B versus that provided in Release A.

Table 3-2. ECS Release B DAAC and SMC Support Enhancements (1 of 2)

SITE	Release A Capabilities	New Release B Capabilities Deployed at Each Site
GSFC	TRMM Mission Support; VIRS Data Ingest, Archive & Distribution; Ingest Ancillary Data; AM-1 Interface Testing; AM-1 MODIS Science Software I&T; V0 Data Migration & Interoperability; TOMS Ozone Data Ingest and Archive; LIS Level-0 Data Ingest, Production, Archive & Distribution; V0 Data Migration & Interoperability; SSM/I & GPCP Ingest & Archive; PR, TMI & GV Data Ingest, Archive & Distribution; LIS Science Software I&T; and System Resource Management.	AM-1 Mission Support; MODIS Level-0 Data Ingest; MODIS Levels 1A, 1B, 2, 3 & 4 Production and Distribution; MODIS Levels 1A, 1B & 2 Archive; COLOR Science Software I&T; COLOR Level-0 Ingest; COLOR Level 1-3 Production, Archive & Distribution; Interoperability with ASTER GDS; Interoperability with New DAACs; and DAS Levels 2-4 Production, Archive and Distribution
LaRC	TRMM Mission Support; TRMM CERES Data Ingest, Production, Archive & Distribution; V0 Data Migration & Interoperability; AM-1 Interface Testing; NOAA Ancillary Data Ingest; TRMM & AM-1 CERES, and MISR & MOPITT Science Software I&T; SAGE Aerosol & Ozone Data, and ISCCP Data Ingest and Archive; and System Resources Management.	AM-1 Mission Support; AM-1 CERES, MISR & MOPITT Level-0 Data Ingest; AM-1 CERES, MISR & MOPITT Level 1-3 Production, Archive and Distribution; METEOR SAGE III Science Software I&T; SAGE III Level-0 Ingest; SAGE III Level 1-2 Production, Archive & Distribution; ACRIM Science Software I&T; ACRIM Level-0 Ingest; ACRIM Level 1A Production, Archive & Distribution; Interoperability with ASTER GDS; and Interoperability with New DAACs.
EDC	Landsat-7 Interface Testing; Landsat-7 Level-0R Data Ingest; ASTER/MODIS Science Software I&T; Ingest and Storage of Landsat-7 Metadata and Browse Data; Ancillary Data Ingest; and System Resource Management.	AM-1 Mission Support; Landsat-7 Support; ASTER Level 1A &1B Data Ingest; ASTER Level 2 Production, Archive & Distribution; MODIS Level 2-4 Ingest; MODIS Level 3 Production, Archive & Distribution; Landsat-7 Data Archive; Landsat-7 Data Access & Ordering Support; Inter-Operability with ASTER GDS; Interoperability with New DAACs; and V0 Data Migration & Interoperability.
ASF	Not Deployed.	Interface to the Alaska SAR Archive for the Access & Distribution of Level 0, 1 -3 ERS-1, JERS-1, ERS-2, and RADAR SAT Data; Archive of Selected ERS-1, JERS-1, ERS-2, and RADAR SAT Level 1&2 Data; Inter-Operability with ASTER GDS; Interoperability with Other DAACs; V0 Data Migration & Interoperability; and System Resource Management. Interoperability with CSA.

Table 3-2. ECS Release B DAAC and SMC Support Enhancements (2 of 2)

SITE	Release A Capabilities	New Release B Capabilities Deployed at Each Site
JPL	Not Deployed.	ADEOS II SeaWinds Science Software I&T; SeaWinds Level-0 Data Ingest; SeaWinds Level 1B & 2 Production, Archive & Distribution (not included in current contract); Non-Redundant AMSR Level-2 Ingest; RADAR ALT DFA Science Software I&T; DFA Level-0 Ingest; DFA Level 1-4 Production Archive & Distribution; RADAR ALT MR Science Software I&T, MR Level 1B Production Archive & Distribution; Inter-Operability with ASTER GDS; Interoperability with Other DAACs; V0 Data Migration & Interoperability; and System Resource Management.
NSIDC	Not Deployed.	AM-1 Mission Support; MODIS Level 2 Data Ingest; MODIS Level 3 Production, Archive & Distribution; Inter-Operability with ASTER GDS; Interoperability with Other DAACs; V0 Data Migration & Interoperability; and System Resource Management.
ORNL	Not Deployed.	Inter-Operability with ASTER GDS; Interoperability with Other DAACs; V0 Data Interoperability; and Limited System Resource Management. Distribution of ORNL Products.
SEDAC	Not Deployed.	Interoperability with Other DAACs (ECS provides software only - SEDAC integrates)
SMC	System Performance Monitoring & Analysis; WAN Management; and System Coordination.	SMC Services Extended to ASF, JPL, NSIDC, ORNL & SEDAC; and Interoperability with ASTER GDS. Centralized Billing.

DAAC interface diagrams are illustrated in Appendix A, Section A.2. These diagrams summarize the functional capabilities, interfaces and data flows between each DAAC and external systems.

3.2 Release B Design Objectives and Drivers

The design for Release B was influenced by a number of important objectives. Foremost among them are the following:

- Ensuring a smooth upgrade of Release A system capabilities and capacities to support Landsat-7 and AM-1 missions. Provide scalability to accommodate future releases.
- Providing a basis for implementing the system design objectives of the ECS architecture presented at SDR. These objectives include allowing for evolution, extensibility, scalabilty, technology insertion, component reuse and site autonomy.

These objectives and the design drivers discussed below presented challenges for the Release B design team. The design not only supports the Landsat-7 and AM-1 Mission objectives but provided the basis for future releases and system evolution.

Numerous trade studies and prototyping activities have been undertaken to support the design decisions. The trades and prototyping efforts are reported in the Trade-off Studies Analytical Data documents (211-CD-001-001 and 211-CD-002-001). These documents discuss important design alternatives, and aspects of evolution to Release B.

The following summarizes the Release B design rationale in the wider context of the original design drivers. The SDR system architecture and how it relates to the Release B design is presented in Section 4. The design drivers fall into the following main categories:

- science drivers
- technology drivers
- system engineering drivers
- policy and funding drivers
- other uses of ECS technology
- independent architecture studies

3.2.1 Science Drivers

The science drivers were derived from various inputs from the scientific community, including those developed by the user and data modeling efforts, input form various science working groups, feedback from regularly scheduled teleconferences between design teams and the science community, and visits with research teams associated with the SCFs. They are described in various white papers and technical reports (e.g., Science-based System Architecture Drivers for the ECS Project, ECS White Paper [193-WP-611-001], EOSDIS Core System Communications and Systems Management Architecture White Paper [MR9401V2], User Scenario Functional Analysis [194-TP-548-001], and ECS User Characterization Methodology and Results [194-TP-313-001]), and can be summarized as follows:

- Facilitate an efficient data search and access paradigm which is easy to use and will be able to deal with sharp variations in access demands
- Support an environment in which scientists can conduct their investigations using information resources in a highly interactive fashion
- Create an infrastructure which is capable to support logical data collections enriched with science information at various levels of abstraction and presentation
- Support the integration of independent investigator tools with those provided by ECS which facilitate the access to ECS data and the use of ECS services
- Facilitate the collaboration among scientists, for example, by making it easy to exchange information and collect data of common interest for shared access and distribution to the community
- Support a dynamic product life cycle and easily extensible product set, while maintaining full version control over science products and source data which are used to generate them
- Provide a data production capability which can accommodate routine and on-demand processing, gives scientists visibility into predicted production schedules as well as production history, and can manage complex data dependencies and processing contingencies.

- Protect against unwanted Application Programming Interface (API) changes throughout the ECS lifecycle

3.2.2 Technology Drivers

Advances in computer and communications technology will enhance the future abilities of scientists to search, access, and process information in a large system such as EOSDIS, and will do so in a perhaps dramatic fashion over the life time of ECS. This will affect the ways in which users of the system will work. ECS needs to anticipate these changes such that design decisions made now make it possible to support future paradigm shifts. Key technology drivers affecting ECS are the following:

- Advances in the fundamental software infrastructure of an evolving information technology industry. These include developments in:
  - Operating systems that support network-based distributed computing
  - Distributed processing and interoperability protocols, and query languages
  - Object-oriented databases and object-extended relational models, including support for heterogeneous, distributed databases
  - Distributed object-based network services
- Networking advances, including the potential for gigabit communications based on advancing network technologies like Asynchronous Transfer Mode (ATM).
- Processing advances, including the continuing performance increases anticipated in desktop workstations, the clustering of such workstations in cooperative problem solving, and the next generation of Massively Parallel Processors (MPP), and the expected advances in I/O associated with processing.
- Advances in permanent storage technologies offering higher densities, higher access rates, and vastly reduced storage costs.
- Advances in Client technologies (e.g., JAVA)
- Advances in internet search and access technologies
- Advances in multimedia technology which promises desktop video-conferencing and sophisticated workstation-based collaboration environments.
- Advances in communications infrastructure and interoperability
- Distributed administration and control to support site autonomy

3.2.3 System Engineering Drivers

The ability of the ECS design to evolve in the future is an important aspect of system engineering. An in-depth discussion of ECS evolvability is contained in the Systems Engineering Plan for the ECS Project [194-201-SE1-001]. Release B implements the ECS architecture, as reviewed during SDR. The following are just a few examples.

- ECS is adopting distributed objects as its long term distributed network computing strategy. Release B makes heavy use of distributed objects. The interfaces between distributed software components follow this paradigm to smooth the path for future transition.

- Release B will fully utilize a distributed advertising service.
- Release B will utilize the distributed infrastructure, supporting Universal References (URs) and data search and access sessions between clients and servers. Additional information on URs for Release B is given in Section 6.1.3.
- Release B will support Internet access standards like Wide Area Information Servers (WAIS) and the HyperText Transport Protocol (http). The ECS project will continue to track these Internet technologies and evolve the ECS with them.
- Release B will utilize advanced database management tools, such as Illustra, which foster enhancements and evolution of DBMS products within ECS.
- Earth Science Query Language (ESQL) - prepares for advanced query capabilities.

3.2.4 Policy and Funding Drivers

EOSDIS will serve a diverse number of organizations over its 20 year mission. ECS must be designed to respond to changes in future budgets, funding policies, and management philosophies. The system must be able to react to such changes in demands for and the priorities of data products. This may include redirecting some portion of product generation computing resources, or employing additional resources from, say, a National Science Foundation (NSF) super-computing center, to the production of key research products.

Policy and funding drivers are discussed in detail in the EOSDIS Core System Science Information Architecture White Paper [194-WP-901-002]. Important policy changes which the ECS design may need to respond to include:

- where data is generated
- what is archived vs. what is created when needed
- resource allocation to specific functions, user types, etc.
- what services are charged to the end-user

This requires a design which parameterizes policy where possible rather than embedding it in software, supports dynamic resource allocations and priorities, and can cope with variations in policy across sites. Care has been taken to ensure that the Release B design decouples software design and policy wherever possible.

3.2.5 Other Uses of ECS Technology

During its 1993 review of NASA's EOSDIS program, the National Research Council (NRC) recommended that EOSDIS be designed such that all users (EOS, non-EOS investigators, DAACs, other data centers) can build selectively on top of EOSDIS components without constraining local implementation of diverse functions or the autonomy of their organization or management. This would permit the EOSDIS program to collaborate in the development of a general multi-agency Global Change Data and Information System (GCDIS), and an expanded version open to general earth science data providers and users (UserDIS).

In response to these recommendations, NASA undertook a study of the potential role for ECS in GCDIS and UserDIS. The GCDIS/UserDIS Study White Paper (193-TP-626-001) presents a dimension of this driver category, in evaluating the needs of a larger community than ECS directly supports. The study explores the concept of an all-encompassing Earth Science information federation, based on complete subsystems like ECS, and linked into a larger "information superhighway." It also attempts to establish a larger context of which ECS is a part, in order that ECS might be able, through its development, to establish standards and components that could be adopted by the global change community at large.

The results of the GCDIS/UserDIS study were an important influence on the design of ECS, primarily because the flexibility and openness of the GCDIS/UserDIS solution closely matched the perceived science drivers discussed above. The Release B design follows the concepts laid down during SDR in terms of distribution, interoperability and autonomy.

3.2.6 Independent Architecture Studies

During the system design activity leading up to SDR, three independent architecture studies were initiated with teams from George Mason University, University of California and the University of North Dakota. These teams developed independent concepts for the ECS architectural design and presented the results in September, 1993 to the EOSDIS project, the science community, and the ECS project. Many of their technical recommendations confirmed the SDPS architecture presented at PDR. For example, there was consensus among the studies that ECS needs to be firmly based on concepts of distributed computing and databases, be able to take advantage of the rapidly declining costs of computing technology, and fit into a wider earth science information network. The ideas presented by the teams have influenced SDPS and CSMS trade studies, for example, the DBMS prototype, the DCE Encapsulation Study, and the Science Data Server Architecture Study.

3.3 Subsystem Design Rationale

The Release B software and hardware architecture, presented in the following sections, responds to a number of system wide issues:

- Reliable production and archiving of earth science data -- Production planning, processing, and ingest subsystem software services are designed to support graceful degradation and effective recovery. For example, production can be switched away from failed resources, processing which cannot be switched due to unique requirements can be suspended, and production adjusted to reduced production capacity based on priority. The design provides flexibility to handle various types of quality assurance for products, on-site as well as off-site. Production history is retained to allow reprocessing in case of data loss. Hardware designs utilize techniques for reducing the likelihood of failures as well as their impact on system operation, such as fault resistant technologies (e.g. RAID staging, HiPPI communications, redundant communications switches and cross connections, fault resistant archive robotics, etc.), and resource pooling to permit graceful degradation in emergency or maintenance situations to prevent catastrophic loss of services.
- Large data rates -- The hardware design employs high speed, low latency technologies coupled with resource pooling to spread I/O loads across multiple system components, reducing the possibility of points of contention and bottlenecks. Examples are the use of multi-tiered local area networks (LAN) provided by CSMS, employing of dedicated sub networks where needed and sharing RAID storage between major system components.

- Large and long term persistent storage -- The design makes it possible to divide the resources into sub-domains for use by data collections and their data servers to spread I/O and resource control over many file servers, and apply heterogeneous storage and access technologies on a site by site basis.
- Scalability -- Software components are designed for distributed operation and for replication of servers on multiple platforms in Release B. The design uses a flexible hardware topology to permit scaling in a variety of manners, for example, provisions exist for the insertion of new storage technology, and the design uses a non-monolithic approach to file server, archive and I/O hardware. Industry standards are employed where possible to provide stable interfaces for future scale-up in hardware. For example, production planning and management will support the execution of product generation algorithms in a distributed environment and support changes in processing topology and the nature of processing resources; data servers are architected for operating in a locally distributed environment using shared and/or dedicated resources as necessary.
- Easily extensible product set -- The software managing the earth science data collection borrows from database management technology to hide the physical organization of data from users and programs; describe the logical aspects of data products in a data server schema and a data dictionary; and include the facilities needed to create these definitions for new products and bring them 'on-line'.
- Evolvability -- The design decomposes the system into services which have well defined interfaces that do not reveal their internal design and adopt interfaces which can be ported to evolving new technologies; adopt open system standards where they are available and design the system to be able to use foreseeable open system standards when they become industry supported.
- Open architecture to support integration of independent investigator tools -- The design provides a 'tool-neutral' client subsystem and includes facilities for inserting new tools into the desktop and workbench, for example, a framework for associating tools with data (e.g., as the default viewing tool); format translators and a framework for extending them; using a uniform mechanism for referencing ECS data and objects which is built around the Internet http protocol.
- Flexible data search and access -- The Release B design provides direct search and access to specific data collections. It contains all the hooks which will be needed to provide data search and access at the distributed system and site level later. Concepts include browsing and searching of advertisements; access to data dictionaries to obtain information about and explanations of products and their parameters; interconnecting the information services into a web of related descriptions accessible, for example, through a web server.
- Low cost of user entry -- The design minimizes the requirements and costs for hosting and obtaining ECS access software. For example, access to a subset of the information (e.g., documents, advertisements) is possible through popular Internet tools such as a web browser. The basic data access and viewing tools in the workbench will carry no license restrictions, can be widely distributed, and will be available for a number of UNIX platforms.

- Preservation of site autonomy -- The ECS design is such that users and science programs need not be aware of site internal policies and hardware / software architecture. Coordination among sites will not require centralized authority. For example, planning and processing subsystem services do not assume centralized operational or planning control.
- Ability to relocate services and data -- The design minimizes the impact of data or service relocation on users and programs, for example, by using a logical method for referencing data and services (the Universal Reference (UR)) and by providing data exchange functions to automate the exchange of the metadata associated with any relocated information.
- Providing components for GCDIS and UserDIS -- GCDIS/UserDIS concepts have been included into the design where feasible and compatible with Release B schedules. Portability of key components across UNIX platforms was and is an important design consideration. For example, the Advertising, Data Dictionary, and Data Server Services are designed to support the needs of a heterogeneous data and information network consisting of autonomously managed sites.
- Data integrity and security -- ECS data will be accumulated at great expense to the nation, and is intended for use in policy decisions which may have long term impact. Protecting the integrity of this data and safeguarding essential ECS processing capabilities while providing open access to the system has been a key concern in the design of the ECS communications and access services.

While trade-off decisions have been made during the design to ensure that Release B will meet the schedules dictated by mission requirements, care will be taken to accommodate these objectives. For example, data server, planning, ingest, and processing subsystem designs are heavily influenced by the demands for scalability to future releases and beyond; the data server subsystem design was driven by the need to provide reliable archiving of data, accommodate an extensible product set, and support a flexible data search and access paradigm.

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